PB88-213848

Pesticide Fact Sheet Number 156: Mevinphos

(U.S.) Environmental Protection Agency
Washington, DC

31 Mar 88

U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO.	2.	3. PB88-213848
4. Title and Subtitle: EPA Pesticide Fact Sheets - Mevinphos No. 156			5. Report Date: 3/31/88
7. Author(s): EPA, Office of Pesticide Programs, Registration Division			8. Performing Organization Rept. No.: 540/FS-88- 073
9. Performing Organization Name and Address: U.S. Environmental Protection Agency, Office of Pesticide Programs, Registration Division (TS-767C), 401 M Street, SW, Washington, D.C. 20460			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address: Same as #9			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the the following actions has occurred.

1. Issuance or reissuance of a registration standard,
2. Issuance of each special review document,
3. Registration of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

17. Document Analysis a. Descriptors

Pesticides, regulations, Chemical Information Fact Sheet, Use Patterns, science findings.

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
SPRINGFIELD, VA. 22161

18. Availability Statement: Publicly Available	19. Security Class (This Report): Unclassified	21. No. of Pages: 12
	20. Security Class (This Page): Unclassified	22. Price

540/FS-88-073

United States
Environmental Protection
Agency

Office of Pesticides and Toxic Substances
Office of Pesticide Programs (TS-766C)
Washington, DC 20460

EPA

Pesticide Fact Sheet

Name of Chemical: Mevinphos
Reason for Issuance: Issuance of Registration Standard
Date Issued: MARCH 31, 1988
Fact Sheet Number: 156

1. DESCRIPTION OF CHEMICAL

Generic Name: 3-[(Dimethoxyphosphinyl)oxy]-2-butenoic acid methyl ester; 3-hydroxycrotonic acid methyl ester dimethyl phosphate.

Common Name: Mevinphos

Trade and Other Names: Apavinphos, Duraphos, Menite, Mevinox, OS-2046, Phosdrin, and Phosfene

EPA Shaughnessy Code: 015801

Chemical Abstracts Service (CAS) Number: 7786-34-7

ENT Registry Number: 22374

Year of Initial Registration: early 1950s

Pesticide Type: Insecticide

Chemical Family: Organophosphate

U.S. and Foreign Producers: E. I. DuPont (U.S.); Amvac Chemical Corp. (U.S.); APA Spa (Italy); Comlets Chemical Industrial Co., Ltd. (Taiwan); GENP International Corp. (Taiwan); KenoGard VT AB (Sweden); and Shell International Chemical Co., Ltd. (England)

2. PHYSICAL AND CHEMICAL CHARACTERISTICS

Chemical Characteristics of the Technical Material

Physical State: Liquid.

Color: Light yellow to orange.

Odor: Mild to none.

Molecular Weight and Formula: 224.1 - $C_7H_{13}O_6P$.

Boiling Point: 99 - 103°C at 0.03 mm Hg.

Vapor Pressure: 0.003 mm Hg at 21°C.

Density: 1.24 at 16°C.

Solubility in various solvents: Miscible with water, acetone, benzene, carbon tetrachloride, chloroform, ethanol, isopropanol, methanol, toluene, and xylene; slightly soluble in carbon disulfide and kerosene; insoluble in hexane.

Physiological and Biochemical Characteristics

Mechanism of Pesticidal Action: Cholinesterase inhibition following contact with, or ingestion of, mevinphos treated surfaces.

Metabolism and Persistence in Plants and Animals: The metabolism of mevinphos in plants and animals is not adequately understood. The available plant metabolism data indicate that mevinphos is absorbed by plant roots, translocated readily to leaves and growing shoots, and is degraded rapidly. The major residues identified in plants are the alpha and beta isomers of mevinphos and dimethyl phosphate. Mevinphos acid is a minor metabolite in plants and it has been demonstrated that mevinphos acid is converted to desmethyl mevinphos acid. It has been suggested that the end products of mevinphos metabolism are methanol, acetone, and carbon dioxide. The available animal metabolism data indicate that twelve hours after dosing 57 to 65% of the ^{32}P-residues was excreted in the urine and feces (45 to 50% in urine; 12 to 15% in feces). Only mevinphos hydrolysis products were present.

3. USE PATTERNS AND FORMULATIONS

Application Sites: Alfalfa, anise (fennel), apples, artichoke, beans, beets (including tops), Bermudagrass (seed crop), birdsfoot trefoil, broccoli, broccoli raab, Brussels sprouts, cabbage, carrots, cauliflower, celery, cherries (sour), Chinese broccoli (gai lon), Chinese cabbage (including napa or nappa cabbage, bok choy, pak choi, gai choy, and mizunal), clover, collards, corn, cucumbers, eggplant, grapes, grapefruit, kale, lemons, lettuce, melons (including cantaloupes, honeydew melons, muskmelons, and watermelons), mint, mustard greens, okra, onions (including green onions), oranges, peaches, pears, peas, peppers, plums, potatoes, raspberries, red chicory [also known as radicchio] (tops), sesame (seed crop), sorghum, spinach, squash (summer), strawberries, tomatoes, turnips (including tops), walnuts, ornamental flowering plants, greenhouse agricultural crops (lettuce), watercress, and sewage disposal plants.

Types and Methods of Application: Foliar application using conventional ground or aerial equipment. Water treatments are permitted in sewage disposal plants

Application Rates: Recommended application rates range from 0.125 to 3.0 pounds of active ingredient per acre.

Types of Formulations: Dust, emulsifiable concentrates, soluble concentrate/liquid, and ready to use.

4. SCIENCE FINDINGS

Summary Science Statement

Mevinphos is an organophosphorus compound and is a potent cholinesterase inhibitor. The Agency has virtually no acceptable toxicity data for mevinphos. However, a high incidence of physician-treated poisonings and hospitalizations due to mevinphos have been noted. Poisoning Reports from California indicate that mevinphos was among the top five pesticides causing occupational poisoning in that state during 1981-1985. The major routes of applicator exposure are through dermal exposure, with some inhalation exposure. Results of a preliminary review of recently received studies are consistent with a Toxicity Category I classification for acute oral and acute dermal toxicity for mevinphos. Mevinphos was not teratogenic in rats at a maternally toxic dose. Data gaps exist for acute toxicity, subchronic effects, chronic feeding, oncogenicity, reproduction, mutagenicity, and metabolic effects. A partial data gap exists for teratogenicity. Mevinphos is very mobile in sandy loam, silt loam, loam, and clay loam soils, however, insufficient data are available for the Agency to fully assess the environmental fate of the compound. Tolerances have been established for a number of raw agricultural commodities, however

additional data are required to support many f them. The Agency has insufficient data to establish an Acceptable Daily Intake (ADI) for mevinphos at this time. Available ecologic effects data show that mevinphos is very highly toxic to aquatic organi s and birds. However, no documented field kills of fish or birds have b n noted. Because of its demonstrated toxicity to nontarget species and ts intended use pattern, mevinphos has been identified by the Office of ndangered Species (OES), U.S. Fish and Wildlife Service (FWS), as be g likely to jeopardize endangered species when used on corn and rghum. Based on this determination, OES specified reasonable and pru nt alternatives to avoid jeopardizing the continued existence of the i ntified species by these uses. EPA is developing a program to reduce or iminate exposure to these species to a point where use does not result i jeopardy, and will issue notice of any necessary labeling revisions when program is developed.

Toxicology Characteristics

Except for a teratology study conducted in t rat, the Agency has no acceptable toxicology data for mevinphos. In t rat teratology study 24 mated female Sprague-Dawley rats were dosed by stric intubation with 0, 0.20, 0.75, 1.00, and 1.25 mg/kg/day of techn l mevinphos in water on gestation days 6 through 15. Based on data f m this study, the Agency determined that the fetotoxic, embryotoxic, and t atogenic NOELs were >1.00 mg/kg/day and concluded that mevinphos does not i duce developmental effects in rats.

Environmental Characteristics

Available data are insufficient to fully assess he environmental fate of mevinphos and transport of mevinphos. Data g s exist for nearly all applicable studies. The available data indicate at mevinphos residues are very mobile in sandy loam, silt loam, loam, and y loam soils. Freundlich K_{ads} values ranged from 0.392 to 1.92 and Freund h K_{des} values ranged from 1.16 to 3.53. Data currently available are i fficient to characterize mevinphos's leaching potential for contaminatior f ground water. Data to characterize the potential to contaminate grou ater are being required. Treated areas should not be re-entered for at ast 96-hours (4-days) for citrus, grapes, nectarine and peach orchards; an 48-hours (2-days) for all other mevinphos treated crops, unless protective othing is worn.

Ecological Characteristics

Avian acute toxicity: Acute toxicity values of 34 mg/kg in the sharp-tailed grouse and 4.63 mg, in the mallard duck.

Avian dietary toxicity: Subacute dietary toxici values ranged from 236 ppm in the Japanese qua to 1991 ppm in the mallard duck.

Freshwater fish acute toxicity: 96-hour acute icity values ranged from 11.9 ppb for ra ow trout to 22.5 ppb for bluegill sunfis

Marine fish acute toxicity: LC_{50} value of 640 ppb for sheepshead minnow.

Freshwater invertebrate toxicity: The acute toxicity values ranged from 0.18 ppb for Daphnia pulex to 5.00 ppb for Pteronarcys californica.

Marine invertebrate toxicity: 96-hour shell deposition EC_{50} value of greater than 1000 ppb for the Eastern oyster; EC_{50} value of 150 ppb for brown shrimp.

These data show that technical mevinphos is very highly toxic to birds on an acute oral basis; highly toxic to upland game birds and slightly toxic to waterfowl on a dietary basis; very highly toxic to both warmwater and coldwater fish species; very highly toxic to aquatic invertebrates; and highly toxic to the brown shrimp and sheepshead minnow and moderately toxic to the Eastern oyster.

TOLERANCE REASSESSMENT

Tolerances have been established for residues of mevinphos in a variety of raw agricultural commodities (40 CFR 180.157). The Agency has evaluated the residue and toxicology data supporting these tolerances and has determined that a full tolerance reassessment for mevinphos cannot be made at this time because of extensive residue chemistry and toxicology data gaps. Because of these extensive data gaps, no significant new uses, including group tolerances, will be granted until the Agency has received data sufficient to thoroughly evaluate the dietary exposure to mevinphos.

In addition to United States tolerances, there are also Canadian tolerances, Mexican tolerances, and Codex Maximum Residue Limits (MRLs) established for mevinphos. However, some incompatibility exists between some of the permanent Codex MRLs and the U.S. tolerances. The issue of incompatibility will be addressed when residue data are submitted and evaluated.

The Agency does not have sufficient data to support the established tolerances for residues of mevinphos alpha and beta isomers in or on all raw agricultural commodities (RACs).

Processing studies are required for apples, citrus fruits, grapes, plums, potatoes, tomatoes, corn, and sorghum.

The initial Acceptable Daily Intake (ADI) for mevinphos was based on a 2-year dog feeding study. On the basis of plasma and erythrocyte cholinesterase inhibition, the No Observed Effect Level (NOEL) in this study was defined as 0.025 mg/kg/day. A safety factor of 10 was used to calculate the ADI of 0.0025 mg/kg/day. The cholinesterase inhibition Lowest Effect Level (LEL) in this study was defined as 0.075 mg/kg/day. When the Agency rereviewed this study in the reregistration review for mevinphos, serious report deficiencies were noted that made the study unacceptable and the Agency found that it was not possible to define the NOEL and LEL doses. The Agency reviewed seven chronic toxicity studies during the mevinphos

reregistration review process and all but one of them (a rat teratology study) were found to be unacceptable. Therefore, the Agency concludes that there is insufficient data to establish an ADI or PADI for mevinphos at this time.

5. REQUIRED UNIQUE LABELING SUMMARY

The following revised environmental hazard statement must appear on the label of all manufacturing-use products containing mevinphos: "This pesticide is toxic to fish and wildlife. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or public waters unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the Environmental Protection Agency."

Personal protective equipment and work safety statements for mixer/loaders and applicators are required to be included on the label of all end-use mevinphos products.

All end-use products containing mevinphos as an active ingredient, must bear the following restricted use labeling statements:

"RESTRICTED USE PESTICIDE

Due to Very High Acute Toxicity to Humans
and
Residue Effects on Avian, Mammalian and
Aquatic Species

For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certified applicator's certification. Direct supervision for this product is defined as the certified applicator being physically present during application, mixing, loading, repair and cleaning of application equipment. Certified applicators must also ensure that all persons involved in these activities are informed of the precautionary statements."

Environmental hazard statements and a bee precautionary statement must appear on the label of all end-use mevinphos products.

The following reentry interval statement and protective clothing for early reentry statement must appear on the labeling of all products except aquatic non-food use products:

"Reentry into treated citrus groves, grape vineyards, nectarine and peach orchards is prohibited for 96 hours (4 days) after the end of application, unless the protective clothing specified on this label for early reentry is worn. Reentry into all other treated areas is prohibited for 48 hours (2 days) after the end of application, unless

the protective clothing specified on this label for early reentry is worn.

FOR EARLY REENTRY INTO TREATED AREAS AFTER SPRAYS HAVE DRIED: Use protective suit of one or two pieces covering all parts of the body except head, hands, and feet; chemical-resistant gloves; chemical-resistant shoes (or chemical-resistant shoe covers or chemical-resistant boots).

FOR EARLY REENTRY INTO TREATED AREAS BEFORE SPRAYS HAVE DRIED, wear all protective clothing specified on this label for an applicator.

Written or oral warnings must be given to workers who are expected to be in treated areas or in an area about to be treated with this product. (Indicate specific oral warnings which inform workers of areas or fields that may not be entered without specific protective clothing, period of time field must be vacated and appropriate actions to take in case of accidental exposure.) When oral warnings are given, warnings shall be given in a language customarily understood by workers. Oral warnings must be given if there is reason to believe that written warnings cannot be understood by workers. Written warnings must include the following information: **DANGER:** Area treated with MEVINPHOS on (Date) _____. **Do not enter without appropriate protective clothing until** (insert date/time reflecting end of reentry interval set forth on this label). In case of accidental exposure see STATEMENTS OF PRACTICAL TREATMENT found on the MEVINPHOS product label."

The following statement must appear on the labeling of all products, except aquatic non-food use products, which permit aerial application: "HUMAN FLAGGERS ARE PROHIBITED during aerial application of this product unless in totally enclosed vehicles."

The telephone number of the National Pesticide Telecommunications Network must appear on the label of all end-use mevinphos product.

6. REGULATORY POSITION SUMMARY

The Agency will not grant any tolerances or any new uses for mevinphos until sufficient data are submitted for the Agency to calculate the Theoretical Maximum Residue Contribution (TMRC) for mevinphos and then will not grant any tolerances or significant new food uses until all of the required residue chemistry and toxicology data have been submitted and reviewed.

The Agency is continuing the restricted use classification of all mevinphos products.

The Agency is establishing the following reentry intervals for end-use mevinphos products: four days (96-hours) for citrus, groves, grape vineyards, nectarine and peach orchards; and two days (48-hours) for all other crops treated with mevinphos.

The Agency is prohibiting the use of human flaggers during aerial application of mevinphos unless the flaggers are in enclosed vehicles.

The agency is requiring the addition of the telephone number of the National Pesticide Telecommunications Network to all end-use mevinphos product labels.

The Office of Endangered Species (OES) in the U.S. Fish and Wildlife Service (FWS) has determined that certain uses of mevinphos may jeopardize the continued existence of endangered species or critical habitat of certain endangered species. EPA is developing a program to reduce or eliminate exposure to these species to a point where use does not result in jeopardy, and will issue notice of any necessary labeling revisions when the program is developed. No additional endangered species labeling is being required at this time.

While data gaps are being filled, currently registered manufacturing use products and end use products containing mevinphos may be sold, distributed, formulated, and used, subject to the terms and conditions specified in the Registration Standard for Mevinphos. Registrants must provide or agree to develop additional data in order to maintain existing registrations.

7. Summary of Major Data Gaps

Toxicology

Acute Oral Toxicity
Acute Dermal Toxicity
Acute Inhalation Toxicity
Primary Eye Irritation
Primary Dermal Irritation
Dermal Sensitization
Acute Delayed Neurotoxicity
Acute Dermal (to define lethality, toxicity, and ChE NOELs)
Subchronic 90-Day Feeding, two species (rodent and nonrodent)[1]
Subchronic 90-Day Inhalation (to define toxicity from greenhouse exposure)
Subchronic 21 Day Dermal
Subchronic Neurotoxicity (conditionally in hen and/or mammal)
Chronic Toxicity, two species (rodent and nonrodent)
Oncogenicity, two species
Teratogenicity (rabbit)
Reproduction
Mutagenicity (full battery - Gene Mutation, Chromosomal Aberration and Other Mechanism of Mutagenicity Studies)
Metabolism

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[1]This requirement is waived since chronic studies are required.

Environmental Fate/Exposure

Hydrolysis
Photodegradation, water
Photodegradation, soil
Photodegradation, air
Aerobic Soil Metabolism
Anaerobic Soil Metabolism
Anaerobic Aquatic Metabolism
Volatility, laboratory
Volatility, field (pending results of the laboratory volatility study)
Terrestrial Field Dissipation
Aquatic Field Dissipation
Soil Dissipation, long term (reserved pending the results of the laboratory fish accumulation study)
Confined Accumulation, rotational crops
Field Accumulation, rotational crops (deferred pending receipt of acceptable confined rotational crop accumulation data)
Accumulation, irrigated crops
Fish Accumulation, laboratory
Field Accumulation, aquatic nontarget organisms (deferred pending the receipt of acceptable accumulation in laboratory fish data)
Leaching and Adsorption/Desorption
Droplet Size Spectrum
Drift Field Evaluation

Ecological effects

Wild Mammal Toxicity
Avian Reproduction (upland game bird and waterfowl)
Freshwater Fish LC_{50} (warmwater and coldwater species) (test material: typical end-use product)
Freshwater Invertebrate LC_{50} (test material: typical end-use product)
Estuarine and Marine Organisms LC_{50} (fish and shrimp)
Fish Early Life Stage and Invertebrate Life Cycle
Aquatic Organism Accumulation
Honeybee - Toxicity of Residues on Foliage
Special Test - (Terrestrial Residue Monitoring of (Avian and Mammalian Food Items)

Residue Chemistry

Nature of Residues (Plants, Livestock)
Storage Stability
Magnitude of Residues

Product Chemistry

All product chemistry studies

B175/10

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